Beeches Pit, opposite Culford, he said that the implements were found in a deposit which seemed to be the end of a terrace of valley gravel which, further down as it was followed towards Icklingham, became more clearly marked, consisting of gravel and brick-earth with pupa, pisidium, and mammalian remains.

The only deposits at all like boulder clay which either in the Beeches Pit or at Botany Bay overlaid these implement-bearing loams, he considered to be the wash either from boulder clay or directly from the chalk as the case might be.

Mr. R. H. Tiddeman then read "Some Observations on the Hyæna Bed at the Victoria Cave, and its Bearing on the Antiquity of Man." After some remarks on the disputed fibula formerly determined to be human, which had been found at a great depth in the cave deposits in the hyæna bed, the author went on to call attention to two bones, one certainly of goat, and another a rib of a small ruminant probably belonging to the same species, on both of which are cuts or hacks which appear to be the result of human workmanship. These were also found in the same bed at the depths respectively of 25 and 15 feet. In considering the age of these it was remarked that the condition of a bone is not necessarily a test of age, and in many instances might be a most fallacious guide. It was admitted that the goat has not been usually considered as introduced into Britain before Neolithic times, but it certainly had appeared in the Victoria Cave in association with the remains of hyæna, *Elephas antiquus*, *Rhinoceros leptorhinus*, and *Hippopotamus*. In the caverns in the neighbourhood of Dinant-sur-Meuse, in Belgium, M. E. Dupont records the goat as occurring in the lower beds in the same association. It seems, therefore, not improbable that it should have occurred in Britain at the same time.

If these are human workmanship, as appears probable, this cave holds only in common with other caves, the works of man so accompanied, and the actual finding of man or his works in the cave is a secondary question compared to the correlation of the beds with certain great and widespread physical changes.

The hyæna bed contains amongst others besides hyæna, the following—*Elephas antiquus*, *Rhinoceros leptorhinus*, and *Hippopotamus*. These were chosen as a well-marked fauna, about which no doubt was entertained that they were contemporary. They occur in non-gravels in France and Switzerland and in the south and east of England, and in each of these countries are associated with man's bones or handiwork. The geologists who have worked chiefly at the drifts of the south of England maintain, and rightly, that these remains are then post-glacial; but to infer that they are so in the north of England may lead to error. Their remains appear to have been removed from the open country there by glaciation, although from their existence in the Victoria Cave and another near Skipton they must at one time have been as abundant in the valleys as they are in the south. The author considered that this later glaciation was on the wane during its maximum at about the parallel of Derbyshire, and it appeared probable from authorities quoted that it had not extended over the southern end of the Pennine Chain. The glacial drifts further south and of earlier age than the animals referred to appeared to be the relics of an earlier glaciation than that of the north country, and extended further south. The author believed that the acceptance of two great and well-marked periods of glaciation differing in their extent would reconcile many of the differences which now exist amongst geologists as to the age of man and the drifts of this and other countries.

An interesting discussion followed, of which we hope to be able to give some account next week.

OUR ASTRONOMICAL COLUMN

The Revolving Double Stars.—Dr. Doberck, of Col. Cooper's Observatory, Markree, has published elements of ξ Bootis, calculated from measures extending over ninety-five years, which interval appears to be about two-thirds of a complete revolution. In this second computation for the same star he has followed a suggestion made in this column (Nature, vol. xiv. p. 475), with regard to the probable interpretation of Sir William Herschel's measures in 1792 and 1795, and his results prove the necessity for the alteration proposed.

We are now indebted to Dr. Doberck for orbits of thirteen of the revolving double stars, calculated in every case in the most complete manner possible from the available data, and which have been communicated from time to time to the Royal Irish Academy. They form collectively a very valuable contribution to this department of astronomy. Col. Cooper may be congratulated on such work emanating from his observatory, and Dr. Doberck likewise on the success which has attended his efforts. We subjoin the periods and eccentricities for Dr. Doberck's stars, omitting only ζ Aquarii, which from the great length of period is open to more uncertainty than the others :—

	Period. Years.	Eccentricity.
γ Coronæ Borealis	95·5	0·350
ξ Scorpii	95·9	0·077
ω Leonis	110·8	0·536
ξ Bootis	127·4	0·708
τ Ophiuchi	185·2	0·582
η Cassiopeæ	222·4	0·576
λ Ophiuchi	241·0	0·493
44 Bootis	261·1	0·710
μ^2 Bootis	290·1	0·617
36 Andromedæ	349·1	0·654
γ Leonis	402·6	0·739
σ Coronæ Borealis	843·2	0·750

The number of binary stars of which the orbits have been determined by various calculators with a greater or less degree of precision, now amounts to twenty-five. The shortest period of revolution hitherto detected belongs to 42 Comæ Berenices, which, according to M. Dubiago, of Pulkowa, in a communication from M. Otto Struve to the St. Petersburg Academy in May 1875, amounts to only 25·71 years. The star was single in 1845 and 1870–71; in 1829 and 1854–55 the distance of the components slightly exceeded six-tenths of a second, which is the greatest separation. The inclination of the orbit to the tangent-plane of the heavens is 90°, or so nearly so that the measures appear to be represented upon this assumption within their possible errors; thus the apparent orbit is a right line, with the direction 11° – 191°. Notwithstanding the difficulty of the case, M. Dubiago has been able to assign the other elements of the orbit with a fair degree of probability as follows :—peri-astron passage 1859·92, angle between the peri-astron and the node, 99° 11′, eccentricity 0·480, semi-axis major 0″·657. The distance of the components at the present time will therefore be 0″·50, with the smaller star on an angle of 11°.

From the elements of ξ Bootis by Dr. Doberck, to which reference is made above, the following appear to be the angles and distances, up to about the epoch of the approaching peri-astron passage, 1898·04 :—

1882·0	Pos.	271·7	Dist.	3″·81		1896·0	Pos.	191°·5	Dist.	1″·57
86·0	,,	259·7	,,	3·29		97·0	,,	174·0	,,	1·36
90·0	,,	242·8	,,	2·71		98·0	,,	150·8	,,	1·21
92·0	,,	231·1	,,	2·38		1899·0	,,	123·5	,,	1·17
94·0	,,	215·3	,,	2·00		1900·0	,,	98·2	,,	1·30

Physical Observations of Mars.—Mr. Marth has communicated to the Royal Astronomical Society an elaborate paper intended to facilitate physical observations of the planet Mars during the favourable opposition of the present year, when it is much to be desired that observations tending to improve our knowledge of the planet may be undertaken by those who are provided with adequate instruments. Mr. Marth has calculated the areographical longitude and latitude of the centre of the disc for the times of about ninety sketches of Mars, by Dawes, von Franzenau, Harkness, Kaiser, Lassell, Lockyer, Rosse, and Secchi, and with the aid of a table applicable to the interval June 9—December 14, with very little trouble the observer will be enabled to refer to the particular drawing which applies the most nearly to the time of any proposed observation, and will thereby be assisted in fixing upon the details of the surface to which it may be desirable to direct his attention. The table contains the angle of position of the axis of Mars, no doubt from Bessel's elements, or rather those deduced by Oudemanns from

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the observations of the Königsberg astronomer, the areographical western longitude and the latitude of the centre of the disc, the apparent diameter, the amount and position of the greatest defect of illumination, and the areocentric angle between the earth and sun, all quantities for Greenwich alternate noon. Vol. xxxii. of the "Memoirs of the Royal Astronomical Society," contains the sketches of Lassell, Lockyer, and Rosse, and this volume alone would be of considerable assistance to the intending observer, as will appear from Mr. Marth's second table.

CHEMICAL NOTES

Crystallisation under Galvanic Currents.—A recent number of the *Journal* of the Russian Chemical and Physical Society (vol. ix., fasc. 2) contains an interesting report, by M. Shidlovsky, on observations he has made as to the microscopical crystallisation of various metals under the influence of a galvanic current. Placing on the object-glass of the microscope two fine metallic plates, the edges of which are about a quarter millim. distant, immersing them in a drop of water and passing a current through, M. Shidlovsky watched the growth of small ramified threads of crystals of metal transported from the cathode to the anode plate. The growth of these tree-like agglomerations goes on very speedily; their branches spread out to the anode plate, vibrate on reaching it, and collapse, whilst another ramified tree grows from the cathode spreading out to the anode; this goes on until the space between the plates is filled with a spongy metallic mass. Each of the metals experimented on (lead, silver, zinc, tin, copper, and iron) gives its own characteristic ramifications, and if the two plates be of different metals the tree has ramifications characteristic of the metal of which the anode plate is made. Gold and platinum do not exhibit any appearance of crystalline trees, nor does the crystallisation appear when the anode is gold or platinum. Iron submitted to a continuous current does not show a transport of crystals, but the phenomenon appears immediately when the currents are originated by a Ruhmkorff's coil or by a Holtz's machine. Iron-powder suspended in water undergoes a rapid motion under the influence of a strong inductive current, forming threads which spread out from the cathode to the anode plate.

Isodibutylene.—The same volume contains the second part of the important paper by Prof. A. Butlérof on the polymerisation of hydrocarbures from the ethylene series:—On isodibutylene.

On the Thermic Formation of Ozone.—M. Berthelot has recently investigated this question by subjecting pure and dry oxygen to the influence of the silent discharge, whilst passing the gas into a flask containing 500 c.c. solution of titered arsenious acid. At the end of thirty minutes, six to nine litres of oxygen had passed through the flask, the temperature being raised one-third of a degree; then by passing the oxygen current without the action of the discharge for an equal time, the thermal data were rendered complete. The arsenious acid solution was then treated with potassium permanganate, and redetermined with a solution of oxalic acid. By this means the quantity of arsenious acid oxidised, and consequently ozone absorbed, was determined. The amount of oxygen absorbed was found to be 30·3 and 51·9 milligrams, corresponding to 90·9 and 155·7 m.m. ozone, the heat set free being 118·2 and 223 calories respectively. Hence for one molecule the heat is equal to + 68·8 calories. Subtracting from this the heat formed in the oxidation of a molecule of arsenious acid + 39·2 calories (Favre and Thomsen), we have + 29·6 calories for the heat set free in the condensation of one molecule ozone into oxygen, and consequently − 29·6 in the reverse process. Ozone therefore is a body in which heat is absorbed in its formation, its activity in combination being probably due to this heat being set free. This is worthy of note when it is remembered that it is condensed oxygen, condensation generally setting free heat.

Chlorophyll in Coniferæ.—Coniferæ are remarkable amongst other plants for developing their chlorophyll even in places which seem perfectly dark. In the Reports of the *Naturforschende Gesellschaft* of Leipzig, Herr R. Sachsse publishes the results of some investigations he made in order to ascertain whether the chlorophyll formed under these circumstances is quite identical with ordinary chlorophyll. He extracted the chlorophyll from young Coniferæ, which had germinated in the dark, by boiling them in alcohol. He obtained a solution which showed the ordinary chlorophyll spectrum; all bands were in the right position and showed the correct grades of intensity. When the solution was concentrated the absorption at the end of the spectrum was continuous, when more diluted the absorption was resolved into the well-known three bands. The only peculiarity in this spectrum, when compared with that of chlorophyll of ordinary origin, was the somewhat lesser intensity of band V. According to Kraus's idea this would prove a predominance of cyanophyll over xanthophyll. The solution of Coniferæ chlorophyll very readily turns to modified chlorophyll.

Chemistry of the Grape.—In several treatises lately presented to the Royal Academy of Physical and Mathematical Sciences of Naples, Prof. G. Licopoli gives an account of some recent micro-chemical researches upon oranges, lemons, and grapes. The latter are of special interest, as Prof. Licopoli tried to determine the time and place at which, in the grape, the different chemical substances which are contained in it (such as tartaric acid, chlorophyll, albuminoid matter, sugar, colouring matter, &c.) first begin to form. The conclusions which the author draws from his labours are the following: Tartaric acid and chlorophyll first show themselves in the tissue of the pistils in course of formation. Oxalate of lime next shows its presence in the sub-epidermic tissue in the form of raphides, in the endocarpic epidermis in the shape of conglomerated crystals (dumb-bells?), and in the kernels in raphides. The albuminoid matter first appears spread over the whole of the fruit, but predominates in the mesocarp. Colouring matter results from the metamorphosis of chlorophyll, its appearance and diffusion showing the growth of the fruit, and the progress the chlorophyll has made at the time of its formation. The growth of this colouring matter begins in the peripherical tissues, and continues towards the central ones. Sugar is found in the pericarp wherever there is tartaric acid present. Resinous matter or wax appears first on the surface of the epicarpic epidermis. Tannic acid is principally formed in the seed, and particularly in the hard and friable part of the episperma; the fibro-vascular fascicles of the pericarp, however, also contain this acid.

NOTES

We regret to hear that the state of health of M. Leverrier, the distinguished director of the Paris Observatory, is causing great anxiety to his friends. He has been entirely prostrated by his enormous labours, which have been almost unceasing for the last twenty years.

M. Belgrand read, at the last sitting of the Council of the Paris Observatory, a report on the necessity of extending telegraph warnings to Algeria, and taking advantage of the documents collected by the Algerine Meteorological Service. The necessary steps will be taken by M. Leverrier, and observations extending from Marocco to Tunis, and from the Mediterranean coasts to Laghouat and Biskra will be sent to and from Paris to every Meteorological Office in connection with the meteorological system. At the same sitting M. Leverrier an-

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